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Notes on the fruits of some species of Opuntia

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(WITH PLATES 9 AND 10)

In the study of the species of *Opuntia* in the field, one is continually impressed by the correlation between structure and environment. The genus is, evidently, of comparatively recent origin and development. As yet no one has been able to make a satisfactory taxonomic disposition of the various species. This, evidently, is largely due to the instability of the characters which the systematist must use to separate the multiplicity of forms which comprise the genus.

A few species are known from humid regions. The genus as a whole is a desert type. Between 90 and 100 species and varieties have been described from the southwestern United States and northwestern Mexico, where they grow under the most arid conditions.

The correlation between the various organs of these plants and the environmental conditions under which they have developed is of great interest, not only to the morphologist but to the student of physiological botany as well. The fitting of form and structure to function under a desert environment has resulted in the development of organs along different lines and with different uses from those of the homologous organs of plants of more humid regions. In order to facilitate nutrition, dissemination, protection, and reproduction, under the adverse environmental conditions where the plants grow, both structure and function are highly specialized.

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In all species the shoot is more or less condensed and fleshy. The roots are also occasionally fleshy, as in *O. macrorhiza* and *O. filipendula.* More frequently the roots are of two sorts, long surface ones for the rapid absorption of moisture, and short deeper ones to give the plant support. The former are of quite different structure from the latter. In many species the fruit has developed along special and circumscribed lines.

Opuntia fulgida is often a tree in habit and size, and grows best in the most arid situations in southern Arizona. It seldom reproduces by natural seeding, depending almost entirely upon vegetal dissemination for its reproduction. In this species the fleshy, proliferous fruits grow in large, pendulous clusters. They are like short vegetative branches, and have few or no spines (FIG. 1). These large fruit-clusters are often sterile, and under the adverse environment the seeds that do develop usually fail to grow. The species, however, has become rapidly and widely spread through vegetal dissemination.

The fruit is usually most abundant on the lower branches and is within easy reach of cattle and other animals. Where undisturbed it remains on the trees for many months after maturing, but because of its succulency and lack of spines it is sought after by wild as well as domestic animals. In this species the ultimate branches are very succulent, densely covered with spines, two inches or less in diameter and four to eight inches long. They are very fragile, becoming detached from the plant with the slightest disturbance. Animals, in their effort to get the fruit, come in contact with them. The fragile branches become detached and adhere to the animals like large burs, finally to fall to the ground, often after being carried for miles. The basal end of the branch usually comes in contact with the soil because of the few short spines at this end, roots rapidly develop, often in the driest of weather, and a new plant becomes established.

The spineless nature of the fruit, its succulency, its growing in large clusters, its remaining attached to the plant for months after maturity and its position within easy reach of cattle and other large animals, are all important factors in vegetal dissemination. I believe that the special acquired function of the fruit as an aid in vegetal dissemination is gradually influencing its character and

form. It is certainly changing from its original seed-bearing condition to one of sterility.

Plants of this species are occasionally observed bearing clusters of short spineless branches which externally closely resemble the clusters of proliferous fruits. These clusters of branches serve the same purpose as the fruits in attracting animals. It is possible that they have developed because of the intimate relation between animal life and vegetal dissemination. The fruit is caulome in structure and through its specialized use is gradually becoming sterile. In instances where the flowers have failed to develop we find these clusters of short fruit-like branches. They differ from the ordinary ultimate branches only in form, size, and want of spines.

In a number of species, specialized branches are developed which are themselves disseminated, *i. e.*, they do not aid in the dissemination of the normal ultimate branches as in *O. fulgida*. In *O. tetracantha*, *O. leptocaulis*, *O. arbuscula*, and other species with long, slender shoots, the wand-like branches are not fragile. They are not readily detached from the plant and they are not disseminated through the agency of animals. Each of these species, however, develops many short, tumid, specialized branches (FIG. 2a and FIG. 3a) but little longer than the fruits. These branches become readily detached, develop roots and form new plants on coming into contact with the soil. Large numbers of these specialized branches develop during dry and adverse seasons. Under more favorable conditions they are almost entirely replaced by fruit.

From the study of the fruit of many species of *Opuntia* from the standpoint of structure, from the similarity in external appearance between the fruit and the ultimate vegetative branches and from teratological evidence as illustrated later in this paper I have been led to the following conclusions:

1. The fruit of *Opuntia* is caulome in structure.

2. Its caulome nature is probably of recent development.

3. It has become caulome by its once superior ovary receding into a vegetative branch, thus making it at present inferior.

4. The branch, which now becomes the ovary, is usually modified and ripens into the structure which we term the fruit; it may however become but little modified, resembling the ultimate branches and continuing as a vegetative part of the plant.

The usual form of the fruit of *Opuntia versicolor* is pear-shaped (FIG. 4). It usually contains a number of well-developed, fertile seeds. It is occasionally sterile, and not infrequently shows no vestige of a seed-cavity (FIG. 5). Sometimes on the same plant with the forms of fruit mentioned above are found structures which resemble the ultimate branches in almost every respect with the exception that there is a seed-cavity containing fertile seeds in the upper end (FIGS. 6, 7, 8). Are all of these structures fruit? In this case there seems to be no dividing line between vegetative branch and fruit. The seeds in developing within the branch have influenced only its upper end. Such branches, although they contain seeds, continue indefinitely as a vegetative part of the plant; often the only external evidence indicating the fruit-character of these structures is the presence of the umbilicus at the upper end.

Throughout the genus *Opuntia* the fruit in its early development bears numerous leaves in the axils of which vegetative branches as well as flowers may occur (FIGS. 1 and 9).

The fruit of the flat-stemmed species of *Opuntia* deviates farthest in form from that of the normal vegetative branch. In *O. Engelmanni* the fruit is usually more or less pear-shaped (FIG. 10). In this species as well as in a number of other flat-branched forms, the structure containing the seeds is sometimes large and flattened like the normal vegetative branches (FIG. 11). In such cases, however, the whole member does not become pulp-like, change color, and ripen in the fall. Only that part immediately surrounding the seeds "ripens" as the seeds mature, the remainder continues as a vegetative part of the plant. When the fruit is sterile it often does not ripen at all but remains on the plant for months after the normal fruits have matured. These sterile fruits occasionally produce normal flattened branches (FIG. 12) during the second season.

The following teratological evidence suggests that the present caulome structure of the *Opuntia* fruit is a successive development from what was formerly a phyllome structure. In the sterile fruit of *O. Engelmanni* (FIG. 13) there is no evidence whatever of a seed-cavity. In this fruit the style persisted for several months after the flower appeared and continued to grow until it reached a diameter several times that of the style in the normal flower. It

became red in color in the late fall, like that of the normal fruit, and developed a central cavity which contained a large number of abortive ovules. In all species of *Opuntia* the large, thick style has a much swollen base; it is possible that this is the last remnant of what was once the seed-receptacle.

The adverse environmental conditions under which *Opuntia* grows is ample reason for this interesting evolution. The ovary, which possibly at one time was superior, has gradually become more and more depressed until now it is entirely enclosed in the fleshy branch.

YALE FOREST SCHOOL.

Explanation of plates 9 and 10

PLATE 9

FIG. 1. *Opuntia fulgida;* cluster of the proliferous fruits: *a*, fruits with fertile seeds and of the usual pear-shaped form; *b*, fruit much elongated, spinescent, and resembling a vegetative branch. × ⅔.

FIG. 2. *Opuntia tetracantha;* section of a long, slender branch bearing a short branch and fruit: *a*, one of the short specialized branches which usually become detached at the end of the first season. × ⅓.

FIG. 3. *Opuntia arbuscula;* short section from a long, slender branch bearing a short specialized branch (*a*), and a flower (*b*). × ⅓.

FIG. 4. *Opuntia versicolor;* normal pear-shaped fruit. × ⅓.

FIG. 5. *Opuntia versicolor;* sterile fruit. × ⅓.

FIGS. 6, 7, 8. *Opuntia versicolor;* structures resembling the normal vegetative branches in external appearance, but containing the seed-cavity with perfect seeds at the apex. × ⅓.

PLATE 10

FIG. 9. *Opuntia leptocaulis;* a fruit bearing two long branches, one of which is floriferous. × ⅓.

FIG. 10 *Opuntia Engelmanni;* normal pear-shaped fruit. × ⅓.

FIG. 11. *Opuntia Engelmanni;* the seed-cavity with perfect seeds in the apex of a flattened branch. × ⅔.

FIG. 12. *Opuntia Engelmanni;* a sterile fruit persisting until the second year and from which is growing a normal flattened branch. × ⅔.

FIG. 13. *Opuntia Engelmanni;* a sterile fruit on which the style has persisted, continued in growth, and formed a central cavity in which are many abortive ovules.

Phycological studies — I. New Chlorophyceae from Florida and the Bahamas

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(WITH PLATES 11–15)

Halimeda scabra sp. nov.

Usually dark green, fading to a yellowish green on drying, strongly calcified and commonly rough to the touch, erect or ascending and forming clusters 6–9 cm. high or sometimes reclinate among other algae and reaching a length of 25 cm.: branching mostly dichotomous, usually frequent or somewhat congested, rarely sparing: segments plane, enervate, discoid, subreniform, suborbicular, or occasionally deltoid-obovate, 4–14 mm. broad, 0.6–1.5 mm. thick, margin entire: peripheral utricles hexagonal in surface view, 27–50μ in diameter, varying from subturbinate to subfusiform in lateral view, 70–240μ long, galeate, $\frac{1}{6}$–$\frac{2}{5}$ of the length consisting of the acuminate, often indurated terminal cusp; lateral walls in contact for only a small fraction of their length, easily separating on decalcification, usually somewhat thickened or gibbous at the angles of contact: filaments of the central strand fusing in twos or threes at the joints: sporangiophores 1.6–2.5 mm. long, rarely simple, mostly once or twice dichotomous, sometimes subracemose, irregularly proliferous, or in part cymose, fringing the margins of the segments or now and then scattered on the flattened faces, each commonly springing from the fusion of two central filaments; the pyriform sporangia 0.16–0.32 mm. broad, for the most part alternately distichous on the ultimate branches. (PLATES 11 and 12.)

Not uncommon on the coast of Florida and the outlying keys from Jupiter Inlet to Key West; also in the Bahama Islands. It grows on a rocky bottom or about the bases of sponges, from low-tide mark down to a depth of at least three meters. The description has been drawn from a study of thirty or more specimens, representing about as many localities, but our fertile spceimen *no. 2905* from Sands Key, Florida (March 30, 1904), which has furnished material for FIGURES 2 and 3 of PLATE 11 and for FIGURES 1, 3, 5, 7–11 of PLATE 12, we consider the nomenclatorial type.

Halimeda scabra is similar to *Halimeda Tuna* in form and habit and it occurs under the latter name in various herbaria. It can, however, be easily distinguished by the always strongly galeate-cuspidate peripheral utricles, a character which, we believe, has thus far been observed in no other species of the genus. These spines or cusps are so large that they are visible under a good hand lens in a properly lighted profile view across a segment-margin even in a dried specimen. The plant is also more strongly calcified than *Halimeda Tuna*, and the peripheral utricles are smaller in surface view and separate more readily on being decalcified. However, *Halimeda scabra* bears a stronger resemblance in outward form to the typical Mediterranean *Halimeda Tuna* than it does to a second South Floridan and West Indian *Halimeda* of the *Tuna* alliance, with which it sometimes grows associated. This second *Halimeda* is larger, always smooth, only slightly calcified, of a bright light green color and lubricous when living and more or less papyraceous on drying. Its segments reach an extreme width, so far as observed, of 35 mm.; and in general, the plant may be said to combine characters of *Halimeda Tuna platydisca* (Decne.) Barton and *H. cuneata* Hering, as these two are limited and defined by Mrs. Gepp (Miss Ethel Sarel Barton) in her admirable monograph on "The Genus Halimeda." * The lateral walls of the peripheral utricles are in firm contact for $\frac{1}{6}$–$\frac{2}{3}$ their length, as in *H. cuneata*, but the peripheral utricles measure 45–120 μ in surface view, while those of *H. cuneata* are described by Mrs. Gepp as 25–40 μ; the filaments of the central strand separate readily at the joints as in *Halimeda Tuna* instead of being coherent as in *H. cuneata*.† This plant has been met with only in a sterile condition. It seems rather violent to identify it either with *Halimeda Tuna* or with *H. cuneata*, and it is possible that further acquaintance with it will show constant and reliable characters for distinguishing it from both. The *Halimeda scabra* and the smooth plant of the *Tuna-cuneata* alliance have been more or less mixed in certain American exsiccatae. Thus, in the *no. 41*

* Siboga-Expeditie. Monographe LX. 1901.

† Mrs. Gepp alludes (*l.c.* p. 16, 17) to a specimen from Rangiroa brought by Professor Agassiz in the *Albatross*, which forms a connecting link between *H. Tuna* and *H. cuneata*, but this has the peripheral utricles of *H. Tuna* and the joint connections of *H. cuneata*.

of the Algae Exsicc. Am. Bor. of Farlow, Anderson and Eaton, issued as *Halimeda Tuna*, out of seven sets examined, three are *Halimeda scabra*, two are the smooth species, and two contain a mixture of the two species. In *no. 167* of the Phycotheca Boreali-Americana of Collins, Holden and Setchell, distributed as *Halimeda Tuna*, out of ten sets examined, eight are *Halimeda scabra*, one is the smooth *Halimeda*, and one is a mixture of the two. The plants from Jupiter Inlet distributed in Curtiss' Algae Floridanae as *Halimeda Tuna*, also include the two distinct species.

The only specimens that we have seen from Atlantic waters approaching the American shores, which seem to agree thoroughly well with the typical *Halimeda Tuna*, are from Bermuda. These we have found also in a fertile condition.

The sporangiophores of *Halimeda scabra* show a good deal of variety in mode of branching, as will appear from the above diagnosis and from the accompanying figures. A comparison with the sporangiophores of *Halimeda Tuna* as figured and described by Derbès & Solier * and by Mrs. Gepp, † and as exhibited in the Bermudian specimens alluded to above, does not seem to bring out any very important or reliable differences. Possibly the sporangia in *H. scabra* are more regularly distichous. The regular *alternation* of the sporangia in *H. scabra* is often interfered with by the suppression of one or more sporangia or by the occurrence of a cluster of two or three where we would normally expect only one, but a real interruption of the *distichous* arrangement is rarely found, while in *H. Tuna* such interruption is perhaps of more frequent occurrence. It should be noted that in *Halimeda scabra* the stalk of the well-matured sporangium shows in most cases a distinct septum or plug, cutting off, more or less completely, the contents of the sporangium from the sporangiophore. This is variable in position, but is commonly near the base of the stalk and is often accompanied by a slight constriction. The plug, which seems to consist of a callose mucilage rather than cellulose, sometimes extends throughout the length of the stalk to the base of the sporangium, in the narrower sense of the word. It is often

* Suppl. Comptes Rendus hebdom. Séances Acad. Sci. 1: 46, 47. *pl. 11. f. 18–22: pl. 12. f.* 1–5. 1856.

† Journ. of Bot. 42: 193–197. *pl. 461.* Jl 1904.

traversed by a central canal, yet in some cases the lumen appears entirely closed. Some apparently mature sporangia show no trace of a septum or plug, but in such instances similar plugs can usually be found in the rhachis of the sporangiophore and it is probable that these may serve as common septa for two or more sporangia. A basal septum or plug has not been attributed to the sporangium of *Halimeda*, so far as we know; in fact, its existence has been expressly denied,* yet from analogy with *Codium*† of the same family, and perhaps we may say from analogy with the known sporangia of the Siphonales in general, its presence is what would be expected. In the fertile specimen from Bermuda, which we believe referable to *Halimeda Tuna*, the material is less well preserved and less mature and the plugs are more difficult to demonstrate, yet we have observed in this also a few undoubted instances of their presence.

We regret that the opportunity for seeing the living zoöspores of *Halimeda scabra* was not followed out. The material preserved with the aid of formaldehyde does not enable one to get a very good conception of the form and size of the zoöspores, but the protoplast of the sporangium often shows a minutely polygonoradial structure at its periphery.

Siphonocladus rigidus sp. nov.

Caespitose, subfastigiate, rigid, the cushions 2–5 cm. high, of a light translucent green when living: primary ramification mostly dichotomous or subdichotomous, the main axes often also with irregular or subsecund, lateral prolifications: filaments 350–1150 μ broad, consisting usually of a single series of cells,‡ but often, especially under the dichotomies, becoming two or three cells in width owing to longitudinal or oblique divisions: cells variable in length, mostly about as long as broad, those of

* Schmitz. Sitzungsber. d. niederrheinischer Ges. f. Natur- und Heilkunde, 1879: 143. 1880.— Wille; Engler & Prantl, Nat. Pflanzenfam. 1[2]: 140. 1890.

† Harvey-Gibson, R. J., & Auld, H. P. Codium. L. M. B. C. Memoirs, IV. 1900.

‡ We are aware that certain modern biologists object to applying the word "cell" to the segments of a coenocytic plant like *Siphonocladus*, but its use in this sense is historically and etymologically more accurate than its proposed modern restriction to the "energid" of certain physiologists. Moreover, no substitute entirely satisfactory to the systematist has been suggested. Proposed equivalents, like "segment," "compartment," and "coenocyte" are often either ambiguous or unnecessarily awkward.

prolifications sometimes 10–20 times as long; wall of filament conspicuously lamellate, 15–70 μ thick (including the enclosed, usually thinner wall of the individual cell); upper face of the diaphragms often strongly mammillose or tuberculose with lamellate elevations, these 30–50 μ broad: filaments sometimes coherent or concrescent at points of casual contact by means of small, usually oval or quadrate, fibular cells: ordinary cells often forming cysts, either as a whole or after endogenous division (PLATES 13 and 14).

Siphonocladus rigidus occurs in southern Florida and in the Bahama Islands, growing in water that is from 3 to 10 dm. deep at low tide, often in association with *Goniolithon strictum* Foslie. It is crisp and rigid when living, crunching under the collector's boot in the water somewhat like the *Goniolithon* whose society it affects. As is common in the family to which it belongs, the dried specimens give a poor idea of the living habit of the plant. Our *no. 1597* from Key West, Florida (October 30, 1902), from which the material used for the published photograph and for most of the drawings was taken, we consider the nomenclatorial type. Specimens collected under this number were distributed in the Phycotheca Boreali-Americana as *no. 1031* under the name *Siphonocladus tropicus* (Crouan) J. Ag.

Siphonocladus rigidus is probably more nearly related to *Siphonocladus brachyartrus* Svedelius,* from Magellan's Straits, than to any other described species, but *S. rigidus* is larger and coarser, the filaments measuring 350–1150 μ in thickness, while those of *S. brachyartrus* are given as but 200–300 μ, the cells are mostly even shorter proportionally than in *S. brachyartrus*, and the branching is more often and more truly dichotomous.

Siphonocladus rigidus is allied also to *S. tropicus* (Crouan) J. Ag., yet is sufficiently distinct as may be gathered from a comparison of our photograph of a fluid-preserved specimen (PL. *13*, F. *1*) with the photograph (PL. *13*, F. *2*) of the dried specimen in hb. Agardh, which was communicated by M. Mazé as "*Apjohnia tropica* Crouan" and may fairly be considered the type of the species, inasmuch as J. Agardh was the first (Till. Alg. Syst. **5**: 105. 1887) really to publish a description of it. The specimens from Florida, Barbados, and Mauritius, also cited by J. Agardh as belonging to

* Svenska Exped. till Magellansländerna, 3: 304. *f. 3* and *pl. 18*. 1900.

that species, as well as specimens in herb. British Museum and herb. Mus. Paris., distributed by Mazé or by Mazé and Schramm as *Apjohnia tropica* Crouan, all maintain the peculiar habit of growth which reminded Agardh of *Chordaria flagelliformis* (*l. c.* p. 103). The most frequent mode of branching in *S. rigidus* is, on the whole, the dichotomous, and dichotomy, so far as we have observed, does not occur in *S. tropicus*. Occasionally, in *S. rigidus*, a fragment in which dichotomies are rare or perhaps wanting and lateral proliferations are numerous, like that illustrated in FIGURE 2, may bear a certain resemblance to *S. tropicus*, but this resemblance, we believe, is illusory,—is even less real than that of *Halimeda scabra* and *H. Tuna*. The cell-walls of *S. tropicus* are comparatively thin, measuring only 3–15 μ in thickness and the axes of the much elongated flagelliform branches are typically two or more cells broad, except at the extreme apices, while in *S. rigidus* the main branches are of a single series of cells for the greater part of their length; in *S. tropicus*, the ultimate lateral branches are rather uniformly and radially developed, in *S. rigidus* they are somewhat secund or very irregular in length and position; the peculiar mammillosities on the transverse walls, often conspicuous in *S. rigidus*, though not always present, we have never observed in *S. tropicus*.

In our earlier studies of *Siphonocladus rigidus* we had believed we saw the formation of zoöspores and pores for their escape through the wall of the cell, but did not succeed in finding such when the time came for drawing up the description. Cysts, however, are of common occurrence, and these may arise either by the separation and rounding off of the individual cells within the common filament sheath or by the endogenous division of these cells and the formation of new walls. The cells of the filament in the ordinary vegetative condition are rather easily separable from each other within the common filament sheath. FIG. 10 shows the result of applying pressure to the cover-slip above a filament-apex which had previously appeared transversely septate.

A curious and noteworthy feature of *Siphonocladus rigidus* is the apparently constant presence of the delicate hyphae of a fungus (?) closely appressed to its surface. These hyphae are variable in abundance, but we have never seen a branch or even a

cell that was entirely destitute of them. The hyphae run, on the whole, parallel to the direction of growth of the host, either singly or laterally connate in bands of 2–4, occasionally with irregular pseudo-parenchymatous anastomoses, as shown in FIGURE 11. The hyphae are 2.5–6 μ broad, and septate, the cells being mostly 4–15 times as long as broad and each containing one or more colorless granules. No reproductive bodies have been observed. The fungus naturally suggests the epiphyte in *Blodgettia confervoides* Harv., to which epiphyte Professor E. Perceval Wright * has restricted the generic name *Blodgettia* under the binomial *Blodgettia Bornetii*, yet the two fungi are evidently different things, that on the *Siphonocladus* not only lacking the "conidia" of the other, but differing also in characters of the mycelium. Being uncertain to what extent fungus and alga may be symbiotically related, we have purposely omitted reference to the fungus in our specific diagnosis, preferring to ground the species on the alga alone. It is within the bounds of possibility that future investigations will serve to emphasize the apparent analogies of *Blodgettia confervoides* and *Siphonocladus rigidus* with the Lichenes and that some day there may be recognized a group of marine lichens in which the alga is the dominating symbiont.

Petrosiphon gen. nov.

A genus of Chlorophyceae of the family Valoniaceae.† Thallus crustaceous, lightly coated with lime, firmly adnate to the substratum by ventral rhizoids and conforming to the inequalities of its surface, composed of coherent irregularly septate tubes, these dichotomously branched or laterally proliferous as in the genus *Siphonocladus* (without septum at base of branch); the determinate progressive margin consisting of usually a single stratum of radially directed tubes, the older parts commonly showing in vertical section several irregularly superposed tubes, mostly with a radial direction, the central part, however, often consisting of vertical tubes of limited growth and nearly equal length, springing from a horizontal hypothallus. Cysts (aplanospores) frequent; other modes of reproduction unknown.

The genus *Petrosiphon* is allied to *Siphonocladus* Schmitz but

* On Blodgettia confervoides of Harvey, forming a new Genus and Species of Fungi. Trans. Roy. Irish Acad. **28**: 21–26. *pl.* 2. 1881.

† See page 250.

is sufficiently differentiated from that by its flat, compact, crustaceous, more or less calcareous thallus, with determinate outline and radio-marginal growth. The type of the genus and the only species known to the writer is

Petrosiphon adhaerens sp. nov.

Forming light-green suborbicular patches, mostly 2–6 cm. in diameter, on rocks, often irregular in outline on an irregular substratum: margins radially striate or sulcate to the naked eye both when living and when dried, everywhere most closely appressed and adnate to the substratum; older central parts sometimes attaining a thickness of 3–5 mm.; tubes mostly 300–580 μ in diameter, those of periphery often nearly straight and sparingly subdichotomous, those of older parts commonly somewhat geniculate; cells ½–20 times longer than broad, cell-walls mostly 6 to 35 μ thick, conspicuously lamellate and often showing also transverse striae on surface; vertical tubes in central portion, when well developed, springing from a comparatively thin hypothallus, this commonly consisting of a single layer of horizontal tubes transformed by the vertical elongation of nearly all their component cells: calcification strongest in the vertical contact planes, the walls in these planes remaining rigid on drying while remainder of exposed wall of surface cells collapses, the surface of thallus becoming thereby radio-sulcate toward margin and usually spongiose-alveolate toward center: special fibular cells very rare, adjacent cells, however, often connected by horn-like or subconical processes: ventral rhizoids very numerous, rock-boring, tortuous, branched, septate, mostly 9–27 μ in diameter: cysts (aplanospores) extremely variable in size and form. (PLATE 15).

Common in the Bahama Islands, growing on surf-beaten calcareous rock near low-water mark and in tide-pools. Our *no. 3322*, collected January 23, 1905, in tide-pools on Silver Cay, near Nassau, from which our published photograph was taken, we consider the type of the species.

The thicker central portions of the thallus of this plant (exclusive of rhizoids) can be readily removed from the rock with a knife, but no specimen adequately representing the thinner marginal parts can be obtained without including also the rock substratum. The delicate rhizoids described above often give a green color to the rock for a depth of 1–2 mm. They are not ordinarily seen at all unless the subjacent rock is carefully decalcified together with the

plant, when they appear as a dense tomentum adhering to the lower surface of all parts of the thallus except a very narrow zone at the growing margin. They are commonly more or less intertangled with filamentous, rock-boring Cyanophyceae. The larger rhizoids are occasionally formed by a ventral evagination of a part of the thallus-tube, the lumina of the two remaining continuous, but the ordinary slender rhizoids, the measurements of which are given above, appear from an early stage to be external appendages to the thallus-tubes, their basal cells standing in about the same relation to the walls of the main cells as do the small fibular cells of *Siphonocladus rigidus* shown in PLATE 14, FIG. 4.

Like *Siphonocladus rigidus*, *Petrosiphon adhaerens* is accompanied by a fungus, or, at least, a chlorophylless filamentous thallophyte, though this is not so uniformly present as in that species; we have never dissected a thallus in which it could not be found, yet large parts are sometimes destitute of it and we are of the opinion that its relation to the alga is that of a parasite rather than that of a subordinated symbiont. The external hyphae lie somewhat loosely among the thallus-tubes or rhizoids; they are fuscous, septate, 2.5–5 μ broad (cells mostly 2–15 times as long), for the most part sparingly branched, straight or sometimes contorted or torulose; the hyphae finally penetrate the walls of the thallus-tubes and follow their cavities in the direction of their growth, meanwhile becoming lighter-colored and forming much-elongated, ribbon-shaped or virgate-fasciculate, decompound clusters of branches; the cells of these endophytic branches are mostly 5–12 μ long, ellipsoid, oblong, or ovoid, and are occupied chiefly by a large vacuole, with 1–3 small refringent bodies usually lying close to the wall. Nothing which could be identified with reasonable certainty as a reproductive body of this fungus has been observed.

The only described species, so far as we can discover, which may suggest itself as possibly congeneric with *Petrosiphon adhaerens* is the minute *Siphonocladus voluticola* Hariot, which grows on the shells of *Voluta* in Tierra del Fuego. But this, according to the original description and figures,* and according to supplementary descriptions and figures by Bornet, † is quite different and

* Jour. de Bot. **1**: 56. 1887; Mission scientifique du Cap Horn **5**: 22. *pl. 1. f. 2–4.* 1889.

† Bull. Soc. Bot. France **36**: clix, clx. *pl. 10. f. 1, 2.* 1889.

probably generically different. It does not form a solid, coherent thallus and nothing is said of a calcareous coating. Bornet (*l. c.*, p. clix) refers this *Siphonocladus voluticola* provisionally to the genus *Gomontia*, but states that this reference is doubtful owing to the imperfect condition of the specimen.

Petrosiphon may, without serious doubt, be placed in the family Valoniaceae as that family is defined by J. Agardh * and by Wille † and perhaps also in the Valoniaceae as more recently limited by Oltmanns, ‡ even though the genus *Siphonocladus*, with which we have compared *Petrosiphon*, is by Oltmanns excluded from the Valoniaceae and made the type of a separate family, the Siphonocladiaceae. But it may fairly be questioned, we think, whether the proposed separation of the Siphonocladiaceae and Valoniaceae as distinct families is not rather difficult and unnatural. The main point of distinction, as pointed out by Oltmanns, appears to be the existence of a "Hauptstamm" in the Siphonocladiaceae, which is lacking in the Valoniaceae. The historical type of the genus *Siphonocladus*, as described and figured by Schmitz, does indeed show a "Hauptstamm," but in most of the species which have since been referred to the genus by Hariot, § Bornet, ‖ Reinbold, ¶ and Svedelius,** the "Hauptstamm" is not readily distinguishable unless, perhaps, in the little-known early stages of growth. In the species described above under the name *Siphonocladus rigidus*, a main axis is soon lost when dichotomies occur as shown in FIGURE 1, but is evident when the branching is as shown in FIGURE 2; nevertheless, both these types of branching are sometimes found in a single tuft and represent, we believe, the variations of a single species.

The specimens from which the above descriptions of new algae have been drawn, including the actual materials which have served as a basis for the published photographs and drawings, are deposited in the herbarium and museum of the New York Botan-

* Till Alg. Syst. 5: 11, 90. 1887.
† Eng. & Prantl, Nat. Pflanzenfam. 1^2: 145. 1891.
‡ Morph. und Biol. der Algen, 1: 255, 269. 1904.
§ Jour. de Bot. 1: 56. 1887.
‖ Jour. de Bot. 1: 56. 1887; De-Toni, Syll. Alg. 1: 358, 359. 1889.
¶ Hedwigia 37: (88) Beibl. 1898.
** Svenska Exped. till Magellansländerna 3: 304. *f. 3* and *pl. 18*. 1900.

ical Garden. The dissections and microscopic preparations, have, however, been transferred from the glass slides, on which they were studied and figured, to glycerine-jelly mounts on slips of mica.

NEW YORK BOTANICAL GARDEN.

Explanation of plates 11-15

PLATE 11. *Halimeda scabra*

1. Photograph of plant, seven-ninths natural size. Specimen collected near Jupiter Inlet, Florida, by A. H. Curtiss, September, 1895.

2. Photograph of portion of fertile plant, one and one-half times natural size. Type specimen, *no. 2905* (Sands Key, Florida).

3. Upper part of the same, three times natural size.

PLATE 12. *Halimeda scabra*

1. Portion of margin of segment, decalcified, in surface view, × 65.

2–6. Peripheral utricles, teased out and decalcified, in lateral view, × 150.

7. Filaments of central strand, showing mode of fusion, × 38.

8–11. Sporangiophores and sporangia; 8 and 11, × 38; 9 and 10, × 24. In Fig. 11, the prevailing distichous arrangement of the sporangia is illustrated and in the older sporangia the position of the basal septum or plug is indicated.

Figs. 1, 3, 5, and 7–11 are drawn from the type specimen, *no. 2905* (Sands Key, Florida) and figs. 2, 4, and 6 from *no.* 2978 (Caesars Creek, Florida).

PLATE 13

1. Photograph of *Siphonocladus rigidus*, natural size. From *no. 1597*, collected at Key West, Florida, October 30, 1902, and now preserved in fluid in the museum of the New York Botanical Garden.

2. *Siphonocladus tropicus* (Crouan) J. Ag. Photograph of specimen in hb. Agardh, communicated by Mazé as *Apjohnia tropica* Crouan, — ⅞ natural size.

PLATE 14. *Siphonocladus rigidus*

1. Portion of plant, showing the more usual ramification, × 5. Near *a*, contiguous branches connected by small fibular cells had been pulled apart.

2. Portion of plant with numerous lateral branches or proliferations, × 5.

3. Surface view of a somewhat similar fragment, × 5.

4. Portion showing the small fibular cells and concrescence of branches at points of contact, × 16, optical section.

5, 6. Fibular cells, × 66.

7. Diaphragm showing mammilliform or tuberculiform elevations, in optical section, × 40.

8. About one-fifth the area of a diaphragm, showing mammilliform or tuberculiform elevations in surface view, × 66.

9. Cysts resulting from the division of the protoplast of a single cell, × 16.

10. One of the filament-apices shown in Fig. 1 as it appeared after crushing under the cover-slip, × 16.

11. Hyphæ of a fungus (?), which is apparently always found on the surface of the cells of *Siphonocladus rigidus*, × 390.

Figures 1, 4–7, and 9–11, have been drawn from our *no. 1597* (Key West, Florida); figs. 2 and 3 from *no. 2771* (Cutler, Dade County, Florida) (similar branching, however, can be found in *no. 1597*); and fig. 8 from *no. 3046* (Hog Island, Nassau Harbor, New Providence, Bahamas).

PLATE 15. *Petrosiphon adhaerens*

A photograph of formalin-preserved specimens collected in tide-pools on Silver Cay, near Nassau, Bahamas, January 23, 1905 (*no. 3322*). The plants were photographed under an enlargement of 1¾ diameters in order to bring out better the radiating component tubes and this magnification is retained in the reproduction. The darker mass just below the middle of the upper right-hand plant is made up of various epiphytes.

Notes on New Jersey violets*

HOMER DOLIVER HOUSE

(WITH PLATES 16–18)

During the spring and early summer of 1904, I was able to make a collection and field study of the violets in the vicinity of New Brunswick, Middlesex County, New Jersey. Several of the species collected have not been previously reported from the state, and this, in connection with the fact that two of them have recently been described as new from Long Island,† and that many of the specimens collected are undoubted hybrids, lends particular interest to the violets of this region.

Among the acaulescent species, the following are either new to the state or deserving of special mention.

Viola Stoneana sp. nov. "*Viola septemloba* LeConte," Stone, Proc. Acad. Phila. **1903**: 678. *pl. 35. f. 2; pl. 39. f. 3.* 1903. Not *V. septemloba* LeConte, Ann. N. Y. Lyc. **2**: 141. 1828. Not "*V. septemloba* Le Conte," Brainerd, Rhodora **6**: 16. 1904.

This species, so well described and figured by Mr. Stone, can in no way be connected with LeConte's species of Georgia, Florida and Alabama. The latter is well described by Mr. Pollard‡ in Small's recent *Flora*, and specimens from that region match well with LeConte's description and his unpublished plate, which I have been able to examine through the courtesy of Dr. E. L. Greene.

V. Stoneana is related to *V. palmata*, having about the same floral characters. The leaves, however, have a characteristic lobation and except for the ciliated margins are nearly glabrous. The capsules from the cleistogamous flowers are suberect on peduncles 5–6 cm. high. The accompanying illustration (PLATE

* Published by permission of the Secretary of the Smithsonian Institution.

† E. P. Bicknell, in Torreya **4**: 129. 1904.

‡ J. K. Small, Flora of the Southeastern United States 891. 1903.

16) was made from fresh flowering plants collected near Milltown (*no. 47*).

The type of *Viola Stoneana* is Witmer Stone's *no. 5113*, collected near Kennett Square, Pa., May 7, 1903. *No. 5112*, a flowering specimen, is identical (National Herbarium numbers, *490405* and *490404*.

Material in the National Herbarium shows the range of this species to extend as far south as Virginia.

VIOLA PALMATA L. Sp. Pl. 933. 1753.

The typical form of this species, if we regard the figure and description of Britton and Brown's *Illustrated Flora*,* as typical; is rare in this region. The following varieties are more abundant than the species.

VIOLA PALMATA VARIABILIS (Greene) Stone, Proc. Acad. Phila. **1903**: 667. 1903. *V. variabilis* Greene, Pittonia **5**: 91. 1902.

Recognizable by the diversified character of lobation exhibited by the leaves and the very dense pubescence. Abundant on dry or sandy slopes and in open woods, near New Brunswick (*nos. 34, 35 and 36*). One of these with variegated flowers is the *Viola palmata variegata* G. Don.†

VIOLA PALMATA ANGELLAE (Pollard) Stone, Proc. Acad. Phila. **1903**: 678. 1903. *V. Angellae* Pollard, Torreya **2**: 24. 1902.

Found only on the hills north of Bound Brook (*no. 32*), and therefore considerably south of the Orange mountains, the type locality. The flowers are much larger and of a brighter blue than the typical *V. palmata*. Like *V. palmata*, it has various "*dilatata*" forms, and if recognized as a species, it must be upon its floral characters, which are more evident in the field than in the herbarium.

All of the subspecies of *V. palmata*, and its allies, often show forms with more or less entire or three-lobed leaves, and this in itself is the best proof of the impropriety of using "*dilatata*" as a subspecific or varietal name. The condition expressed is merely

* Britton and Brown, Illustrated Flora **2**: 446. 1897. *f. 2484.*

† Gen. Syst. **1**: 321. 1831.

a "form," and often not even that. The species or subspecies designated by Elliott * as *V. palmata dilatata*, is probably distinct from the more northern so-called var. *dilatata*.

Viola Brittoniana × cucullata hyb. nov.

Glabrous, light-green, 1.5–2 dm. tall; mature leaves triangular or triangular-ovate in outline, shallowly cordate or nearly truncate, divided into 5–9 somewhat irregular lobes, the lobes cut one-half to two-thirds of the distance to the petiole, the margins irregularly crenate-dentate; petioles two to three times as long as the blades; flowers similar to *V. cucullata*, the petals somewhat narrower; cleistogamous flowers and capsules also similar to *V. cucullata*, but the peduncles shorter.

This is apparently the same as the plant mentioned by Mr. Witmer Stone † as a possible hybrid between *V. Brittoniana* and *V. cucullata*. Its characters and habitat seem to favor such an assumption. The cleistogamous capsules are usually more or less abortive when mature and the petaliferous flowers apparently never develop capsules bearing seeds, which is the case with both *V. Brittoniana* and *V. cucullata*. The accompanying illustration (PLATE 17) was made from living plants collected near Milltown (*no. 62*, June 5, 1904, type in herb. House; and *no. 79*, June 14, 1904) and growing in close proximity to both *V. Brittoniana* and *V. cucullata*. *Viola notabilis* Bicknell,‡ described from Long Island, should also be referred to this hybrid.

VIOLA PECTINATA Bicknell, Torreya **4**: 129. 1904.

Found near Dayton, Middlesex County, in low meadows and along ditches (*no. 15*, May 10; *no. 57*, May 30, 1904). Apparently an excellent species, and notable in being discovered both on Long Island and New Jersey at about the same time. The withered petioles of former seasons are more or less persistent, the basal auricles of the sepals are short and blunt and not at all suggestive of either *V. Brittoniana* or *V. emarginata*, to which the species is apparently related. The cleistogamous flowers are sagittate, on erect peduncles 5–7 cm. long; their oblong capsules about 1 cm. long. (PLATE 18.)

* Bot. S. C. and Ga. **1**: 300. 1817.

† Proc. Acad. Phila. **1903**: 680. 1903.

‡ Torreya **4**: 131. 1904.

VIOLA NEPETAEFOLIA Greene, Pittonia **5**: 92. 1902.

A peculiar little species with elongated, deeply cordate and very narrow leaves. Found near Dayton (*no. 22*, May 10, 1904). Related to *V. affinis* LeConte, from which it differs in its leaf-characters and the densely pubescent capsules of the cleistogamous flowers.

VIOLA CONJUGENS Greene, Pittonia **4**: 3. 1899.

Found in two localities near New Brunswick and Milltown (*nos. 25 and 40*). In both instances, growing with a form of *V. fimbriatula* (*no. 24*) the leaves of which approach *V. sagittata* in shape, yet are densely pubescent. *V. conjugens* differs from it by its oblong-ovate and cordate leaves, less pubescence, and its larger flowers of a deeper violet-blue color. It is possibly a hybrid.

VIOLA FIMBRIATULA J. E. Smith, in Rees Cyclop. No. 38. 1817.
V. ovata Nutt. (1818.)

The most abundant violet of the region and also the most variable. It shows all gradations into *Viola fimbriatula aberrans* Stone,* and a close study of this variety in the field leads me to agree with Mr. Brainerd† in calling it a natural hybrid. It in turn seems to pass into *V. Porteriana* Pollard,‡ excellent specimens of which occur at Lindenau, near New Brunswick (*nos. 54 and 67*) and, in the field, also show all indications of being true hybrids.

V. fimbriatula is subject to such great variation that it will be a matter of great difficulty properly to express, in terms of species, the several hybrids which result from the crossing of the numerous potent forms of *V. fimbriatula*, and *V. sagittata*, with other and more constant species. My own observations upon the violets of this region convince me that such species as *V. fimbriatula*, *V. sagittata*, *V. palmata*, *V. cucullata*, *V. emarginata*, and *V. Brittoniana*, do produce seeds from the petaliferous flowers, which are capable of germination and growth, and much as I was loath to admit the fact, I was convinced that not only a few, but that numerous hybrids exist between these species and others.

VIOLA SAGITTATA Ait. Hort. Kew. **3**: 287. 1789.

In its typical form (*nos. 60 and 61*) this species is nearly or

* Proc. Acad. Phila. **1903**: 683. *pl. 37. f. 4, 6.* 1903.
† Rhodora **6**: 218. 1904.
‡ Bull. Torrey Club **24**: 404. 1897.

quite glabrous, but forms occur, and usually more abundantly, which are more or less ciliate or even pubescent and it is often difficult to determine whether the specimens under consideration should be referred to *V. sagittata*, to *V. fimbriatula*, or to some hybrid form.

The key to the species and varieties of violets of New Jersey given below contains 33 species and varieties, of which 29 occur in Middlesex County, and are indicated by a star. Further report of the hybrid forms will be made by President Ezra Brainerd of Middlebury College, to whom they have been referred.

KEY TO THE SPECIES OF NEW JERSEY VIOLETS.

I. Acaulescent; flowers scapose.

A. Plants stoloniferous.
- Corolla purple; introduced, fragrant species. — *1. *V. odorata.*
- Corolla white or yellow.
  - Corolla yellow; leaves orbicular. — 2. *V. rotundifolia.*
  - Corolla white.
    - Cleistogenes deflexed; leaf-blades from broadly ovate to orbicular.
      - Upper and lateral petals twice as long as broad; petioles not spotted. — *3. *V. blanda.*
      - Upper and lateral petals thrice as long as broad; petioles red-spotted. — *4. *V. LeConteana.*
    - Cleistogenes erect; leaf-blades from narrowly oval to linear.
      - Leaf-blades from lanceolate to linear-lanceolate. — *5. *V. lanceolata.*
      - Leaf-blades oval or ovate-oblong. — *6. *V. primulaefolia.*

B. Plants not stoloniferous.
- Cleistogamous flowers wanting; petals beardless; leaves divided.
  - Upper petals purple, lower blue. — 7. *V. pedata.*
  - Upper and lower petals of the same color. — *8. *V. pedata linariloba.*
- Cleistogenes usually present; lateral and often the lower petals bearded.
  - Cleistogamous flowers deflexed, horizontal or on short spreading peduncles.
    - Plant glabrous or nearly so.
      - Leaf-blades attenuate; petioles glabrous; petals light-blue.
        - Leaf-blades but little longer than broad. — *9. *V. affinis.*

Leaf-blades twice as long as broad, deeply cordate. *10. *V. nepetaefolia*

Leaf-blades acute, deeply cordate; petioles pubescent; petals deep purple-blue, the upper ones reflexed. *11. *V. papilionacea.*

Plant pubescent or hirsute.

Leaves entire.

Plant less than 1 dm. high; leaves spreading, hirsute above, glabrous beneath. *12. *V. villosa.*

Plant more than 1 dm. high; leaves erect, softly pubescent throughout. *14. *V. palmata variabilis.*

Leaves lobed.

Lobes extending about to center of the blade, or blades deeply 3-lobed. *13. *V. palmata.*

Lobes extending nearly or quite to the base of the blade, lobes more than 3.

Corolla deep purple-blue, early leaves entire. *14. *V. palmata variabilis*

Corolla light-blue; early leaves lobed. *15. *V. palmata Angellae.*

Cleistogenes erect or ascending on long peduncles.

Leaves lobed or divided.

Sepals with short blunt auricles at base; leaves ciliate; cleistogenes on peduncles 5–6 cm. long. *16. *V. Stoneana.*

Sepals long-auricled at base; plants glabrous; cleistogenes on peduncles 10–15 cm. long.

Lobes extending nearly to base of blade, the 5–9 lobes linear-lanceolate, the middle lobe 3-divided. *17. *V. Brittoniana.*

Lobes irregular, extending to or somewhat beyond the middle of blade. *18. *V. Brittoniana* × *cucullata.*

Leaves entire; crenate or dentate, or incised at the base, not deeply lobed.

Leaf-blades cordate-ovate or cordate-oblong in outline.

Plant glabrous; leaf-blades cucullate, broadly ovate-cordate, sinuate-dentate. *19. *V. cucullata.*

Leaf-blades pubescent; crenate-dentate.

Leaf-blades oblong-ovate, blunt, shallowly cordate. *20. *V. conjugens.*
Leaf-blades ovate, deeply cordate, acute. *22. *V. fimbriatula aberrans.*
Leaf-blades not cordate-ovate or cordate-oblong in outline.
Leaf-blades ovate-sagittate or oblong-lanceolate and sagittate.
Plant densely pubescent or villous; petioles usually shorter than the blades. *21. *V. fimbriatula.*
Plant glabrous or ciliate; petioles usually longer than the blades. *23. *V. sagittata.*
Leaf-blades triangular in outline, dentate or incised at the base.
Plant sparingly pubescent; leaf-blades longer than broad, usually dentate at base. *24. *V. Porteriana.*
Plant glabrous; leaf-blades mostly broader than long.
Auricles of the sepals very long; blades dentate or incised at the base. *25. *V. emarginata.*
Auricles of the sepals short and blunt; leaf-blades conspicuously pectinate. *26. *V. pectinata.*

II. Caulescent; leafy-stemmed.

A. Corolla yellow; leaf-blades ovate-reniform, entire.
Plant pubescent; root-leaves usually wanting. *27. *V. pubescens.*
Plant glabrate; root-leaves usually present. *28. *V. scabriuscula.*
B. Corolla purple, white or cream-colored.
Stipules entire; petals white or tinged with purple. 29. *V. canadensis.*
Stipules incised or pinnatifid.
Perennial; stipules much smaller than the leaf-blades.
Petals cream-colored, the lower ones purple-veined. 30. *V. striata.*

Petals blue or purple, rarely white.		
Spur shorter than the petals.	*31.	*V. labradorica.*
Spur longer than the petals.	*32.	*V. rostrata.*
Annual; stipules nearly as large as the blades.	*33.	*V. Rafinesquii.*

Sets of the violets collected in Middlesex County have been placed in the herbaria of the New York Botanical Garden and the National Museum, and in the private herbaria of Mr. Witmer Stone and President Ezra Brainerd. The first, and therefore most complete set, is retained in the writer's own herbarium.

UNITED STATES NATIONAL MUSEUM.

Explanation of plates 16-18

PLATE 16

Viola Stoneana House, natural size. *A*, flower capsule. *B*, cleistogamous capsule.

PLATE 17

Viola Brittoniana × *cucullata* House, natural size. *A*, cleistogamous flower. *B*, cleistogamous capsule.

PLATE 18

Viola pectinata Bicknell, natural size.

Bryological Notes — II

Elizabeth Gertrude Britton

Some changes in generic names

Some recent studies of Dr. Small's subtropical Florida collections and of the mosses gathered by me in the Bahamas on two recent expeditions, as well as those from Jamaica collected by Mr. Harris, Mr. Maxon, and Professor Underwood, make it desirable to record some of the discoveries which I have made in trying to place some of the most puzzling species.

The following species was announced as a new species of *Cryphaea* at the Philadelphia meeting of the Sullivant Moss Chapter in December, and drawings were shown of it. I have since found that it is a common West Indian species which does not belong to any of the genera to which it has been referred, so I propose a new generic name, **Pseudocryphaea,** to include the one and only species known to me:

Pseudocryphaea flagellifera (Brid.)

? Hypnum nudicaule Schwaegr. Suppl. **1**[2]: 223. 1816.
? Pterigynandrum nudicaule Brid. Bryol. Univ. **2**: 182. 1827.
Pilotrichum flagelliferum Brid. Bryol. Univ. **2**: 259. 1827.
Neckera domingensis C. Müll. Syn. Musc. **2**: 95. 1850.
Cryphaea? leptoclada Sull. Proc. Am. Acad. **5**: 283. 1861. — Paris, Index 289.
Leucodon domingense Mitt. Jour. Linn. Soc. **12**: 409. 1869. — Paris, Index 755.

From the number of different genera in which it has been placed it is evident at first sight that there is something wrong with this species. It is not a *Leucodon*, as the leaves are costate; it is not a *Pilotrichella*, though it resembles *P. cymbifolia* in the slightly papillose leaves, formed by the projecting ends of the cells; the cells of the leaves resemble more closely those of *Leptodon trichomitrion*, but the plants differ in their striking method of branching and forming slender flagella; the specific names given

to it by various authors show this to be the most marked characteristic of the species. The same habit is described by Correns in *Leucodon sciuroides*. He states that it is dioicous and seldom fruits and is propagated by brittle branchlets, a habit of tree-growing species. The young stems are unbranched and simple, but later they have short, small-leaved lateral branches which are brittle and fugacious!

The fruit has not been carefully described. This is a translation of what Müller says of it:

"Perichaetium long-exserted, very narrow, pale; leaves long lanceolate-acuminate, convolute, long-reticulate; capsule on a long slender yellow pedicel, erect, ovate, brownish.

"Very common throughout the Antilles and the neighboring borders of Venezuela, but very rarely fertile, first collected by Bertero in San Domingo.

"A very beautiful and very distinct species. Fruit of *N. longiseta*."

We have this species from five stations near Miami, Florida, where it has been collected by *Garber* and by *Small;* also at Lake Harris, *J. D. Smith*, 1879. It was distributed from Cuba, *Chas. Wright 68;* Porto Rico, *Sintenis 53*, *Heller 578* and *820*, *O. F. Cook 1031;* Jamaica, *Underwood 2981* and *2015*, and *Maxon 843*. Also from Mexico, near Cordova, *C. Mohr*, 1857 and *Pringle 2146*.

In searching through the literature to see whether this species had previously been recorded from the United States, I found in Kindberg's *European and North American Bryinæ* that he includes *Alsia abietina* under *Leptodon* with *L. Smithii*, the type of the genus; that he separates *Leptodon trichomitrion* under *Forsstroemia* Lindberg, including five North American species; that he places under *Alsia*, *A. longipes* and *A. circinnata* (Brid.); and transfers *Alsia californica*, the type species of this genus, to *Antitrichia* and rechristens it *Antitrichia pseudo-californica*, because there was already an *Antitrichia californica* Sull. He transfers this last species to a new genus and calls it *Macouniella californica* Kindb. There are five distinct propositions here which will be taken up separately.

There is no question that *Leptodon Smithii* resembles *Alsia abietina* Sull. in its circinate habit, but it is a very superficial resemblance, which the leaf-characters at once dispel! There is a much greater resemblance to *Pterobryum densum* Hsch. in the shape, serration and venation of the leaves; but the prominent spinose

teeth on the back are peculiar in *A. abietina*, and resemble those of *Pterogonium gracile*, though the size and habit of the plants is quite distinct, as well as the leaf-characters.

Most bryologists will admit that *Leptodon Smithii* and *L. trichomitrion* are not congeneric and accept *Forsstroemia* Lindb. for the latter and its allied species; but Paris' *Index*, although accepting both genera, limits *Forsstroemia* to *F. trichomitrion* (Hedw.) Lindb. and some other exotic species, and leaves most of our North American species in *Leptodon* with *L. Smithii*. Kindberg is more nearly correct in the list of species he includes, but *Cryphaea Ravenelii* belongs where Austin placed it!

Jaeger in the *Adumbratio* listed three of our species under *Lasia* Beauv. 1805 (*non* Bridel) but this generic name is antedated by *Lasia* Loureiro, 1790, and that is why Lindberg substituted *Forsstroemia* in 1862. Sullivant made an anagram of *Lasia* when he described *Alsia* because of the resemblance between *Lasia trichomitrion* (Hedw.) Beauv. and *Alsia californica* Sull. This is the type species of *Alsia* and its synonymy is as follows:

ALSIA CALIFORNICA (Hook. & Arn.) Sull. Proc. Am. Acad. Arts & Sci. **3**: 185. 1857; Musc. Wilkes Exp. 25. *pl. 25*. 1859.

Neckera californica Hook. & Arnott, Bot. Beechey Exp. 162. 1833.

Antitrichia pseudo-californica Kindb. Eu. and N. A. Bryin. 9. 1897.

It started as a monotypic genus, and it was not till 1864, in the *Icones*, that Sullivant enlarged the genus to include *Neckera abietina* Hooker. This was undoubtedly a mistake which Kindberg has detected, but failed to rectify in the correct way. I therefore propose the following new name:

Dendroalsia

Type species: **Dendroalsia abietina** (Hook.)

Neckera abietina Hook. Musc. Exotici *pl. 7*. 1818.

Pilotrichum abietinum Brid. Bryol. Univ. **2**: 258. 1827.

Type locality: N. W. Coast of North America. *Menzies*, 1792.

Type in herbarium of Hooker.

These plants were figured 6 inches high, with stems naked

at base for 2–3 inches, simply pinnate or bipinnately compound (often with flagelliferous branches 2–3 inches long) leaves long-acuminate. The cells are dorsally papillose to base, papillae are larger at apex, spinose especially on the end of the vein, seta not entirely immersed, capsule cylindric, 3 mm. long; peristome pale, papillose and densely nodose: endostome slightly perforate, also pale and papillose.

Hooker says that the peristome is red and the endostome pale-yellow, but Schwaegrichen, *pl. 140*, in a colored plate, figures the peristome as a light yellowish-green.

Apparently this is a very rare species and it is doubtful if Sullivant saw typical specimens!

It is also to be remembered that Sullivant included among the synonyms of *Alsia abietina* his *Leptodon circinalis*. Again it seems clear that Sullivant made a mistake in supposing that Hooker's specimens were the same as his and in stating that Hooker's specimens were not typical and that the smaller circinate plants were the antheridial plants of the larger. He says: "The specimens collected by Menzies, and figured by Hooker and Schwaegrichen (*l.c.*), are unusually elongated and distinctly pinnate, owing doubtless to local influences, and therefore do not represent the normal form of the species, as here figured from numerous specimens furnished by other collectors." A comparison of Sullivant's figures with those cited above will show the macroscopic as well as the microscopic differences between these two species. Specimens of *Dendroalsia abietina* have been sent to me by J. B. Leiberg from granite ledges near Lake Pend d'Oreille, Idaho, which measure 8–10 inches in length, are doubly pinnate and have long slender flagellate branches. They are also much less circinate and show other differences from the smaller species, as the following synopsis and description will indicate:

Plants 4–10 inches high. Leaves papillose to base.	*D. abietina.*
Plants 2–4 inches high. Leaves papillose only at apex.	*D. circinalis.*

Dendroalsia circinalis (Sull.)

Leptodon circinalis Sull. Bot. Pac. R.R. Survey. **4**: 189. *pl. 1.* 1856.

Alsia abietina Sull. (in part) Icon. Musc. 115. *pl. 72b.* 1864.

Alsia Macounii Kindb. Bull. Torrey Club **17**: 275. 1890.

Plants seldom more than 3–4 inches high, more circinate when dry than *D. abietina:* leaves shorter, 1 mm., and broader, 0.5 mm., ovate-lanceolate, less serrate and acuminate at apex, papillose only above the middle, papillae smaller and more numerous; base broader with strongly revolute margins, vein stouter and less spinosely toothed at apex: capsules shorter and broader, with a shorter seta more completely immersed in the broader and less pointed, perichaetial leaves; peristome longer and more slender, less papillose; endostome perforate; spores larger and rougher.

According to Kindberg, the only American species of *Alsia* is *A. longipes* Sull. & Lesq., with which he associates a European species of *Eurhynchium, E. circinnatum* (Brid.) Br. & Sch. This is another case of incomprehensible confusion, for apparently, there is no resemblance, either superficial or real between these two species.

Alsia longipes has the leaf-characters of *Dendroalsia*, but differs in its sporophyte in several ways, having a long-exserted seta, a cylindric capsule and an endostome with appendiculate cilia. Still there seems no necessity for separating it from the other allied species, so the following name is proposed:

Dendroalsia longipes (Sull. & Lesq.).

Alsia longipes Sull. & Lesq. Musc. Bor.-Am. Ed. 2. *No. 399.* 1865. Sull. Icon. Musc. Supp. 85. *pl. 63.* 1874.

Type station: On shaded rocks in deep canyons, Oakland, California, *Bolander.* This species must be rare, as it is recorded from only two other stations in California, *viz.*, near Berkeley, *M. A. Howe*, and southern California, *McClatchie*, and one in Alaska.

MACOUNIELLA Kindberg.

It is with much regret that I am forced to believe that the genus *Macouniella* Kindb. will not stand. As has already been stated, the genus was founded on *Antitrichia californica* Sull. and some specimens from France were referred to it. The type species of *Antitrichia* is *A. curtipendula.* Limpricht in the Laubmoose maintains in the same genus *A. californica* Sull. to which *A. curtipendula* var. *hispanica* Sch. including specimens from Algiers,

Spain and Italy, had been referred by Schimper himself. He gives a short and excellent key to separate them, which is translated as follows:

Leaves plicate, with accessory veins.	*A. curtipendula.*
Leaves not plicate, with only one vein.	*A. californica.*

A careful comparison of European specimens, descriptions and illustrations has convinced me that all five of the differences claimed by Kindberg to separate var. *gigantea* as a species, are variable and unreliable. A large series of European specimens in the Jaeger Herbarium shows this and the description given by Limpricht in the *Laubmoose* indicates a variable species. He states that the stems may be simple or branched, the branches thick at the apex or slender, often flagellate; the leaves mostly serrate, with 1–2 accessory veins on each side of the midvein; and the seta straight or curved. He recognizes two varietal names in a footnote but evidently considers them of little importance.

Antitrichia tenella Kindb. and var. *flagellifera* R. & C. seem referable to *A. curtipendula* and are probably one and the same thing.

THE AMERICAN SPECIES OF ERPODIUM

In both editions of Paris' Index Bryologicus this genus is credited to Bridel, yet he used it only as a *subgenus* of *Anoectangium* and Carl Müller (Bot. Zeit. **1**: 774. 1843) was the first to use it as a generic name. Of the 20 species recognized, 9 are credited to America, 3 are from Paraguay, 2 from Argentina, 2 from Brazil, 1 from Mexico and 1 from the West Indies. Of these *Erpodium domingense* is reported as having been collected in Cuba, Jamaica and Porto Rico, but the type station Sto. Domingo is omitted from the second edition, though it is the only one cited in the first! Recent collections from Jamaica by Professor Underwood include one specimen of this rare and interesting genus, which I have referred to *Erpodium domingense* from the descriptions only, not having any specimens for comparison! *Erpodium domingense* is the type species.

ERPODIUM DOMINGENSE (Brid.) C. Müll. Bot. Zeit. **1**: 773. 1843. *Anoectangium Erpodium domingense* Brid. Bryol. Univ. **2**: 167. 1827.

Anoectangium? domingense Schwaegr. Suppl. *pl. 267.* 1829–30.
Pilotrichum domingense C. Müll. Syn. Musc. **2**: 184. 1851.

Type locality: Sto. Domingo. Coll. *Balbisius.* On trees.

Plants closely appressed, light-green or brown; stems creeping and rooting, branches short and irregular. Leaves imbricated and appressed, overlapping half their length, ecostate, entire but the margins crenulate with papillae; apex rounded; cells large, 0.013 x 0.018 mm., all thick and obscure; basal cells longer and smooth: autoicous: antheridia few, in a small axillary bud without paraphyses: archegonia terminating short lateral branches; perichaetial leaves with acute spreading points: seta short, nearly or quite immersed: capsules erect, 1 mm. long, cylindric, pale-yellow, contracted below the mouth when dry, walls parenchymatic, thin at base; neck stomatose; peristomes none, lid conic, apiculate; calyptra not seen; spores green, smooth, 0.027–0.032 mm.

On trees in Sto. Domingo, Porto Rico and Hope Mines near Kingston, Jamaica, *L. M. Underwood 4*, 24 January, 1903.

Remarkable for its resemblance to the *Hepaticae*, especially certain species of *Frullania* for which it has been mistaken and hence probably has seldom been collected.

Erpodium cubense E. G. Britton, n. sp.

Erpodium domingense fide Paris Index ed. 2. 156?

Only a few scraps selected from Charles Wright's Cuban Hepaticae by C. F. Austin have been seen, so the general aspect of this species is unknown, but the leafy stems are similar to those of *Erpodium domingense* and might easily be mistaken for them. The leaves, however, are smaller and more blunt at apex; the marginal apical cells are rectangular and smaller, only 0.005–0.008 mm. and obscure, with small dense papillae; the cells are rhomboidal in the upper part of the perichaetial leaves and 0.008 x 0.013 mm.; the capsule is sessile and quite immersed, only 0.5 mm. long, "with a fragmentary peristome" *fide* Austin; the calyptra 0.25 mm. with lobed base; spores 0.013 mm. Found by Austin with *Lejeunea, no. 201g* of Wright's Cuban Hepaticae. Type from the Herbarium of C. F. Austin.

Type locality?

This species differs from *E. domingense* in having leaf-cells one-half the size and more dense and obscure, and in its smaller and immersed capsule.

These specimens were in the herbarium of P. V. LeRoy for many years and have been purchased by the New York Botanical Garden.

ERPODIUM BISERIATUM (Austin) Austin, Bot. Gaz. **2**: 142. 1877. *Lejeunea biseriata* Austin, Proc. Acad. Sci. Phila. **21**: 225. 1869.

Stems slender, 1 cm. long and (with leaves) about 1 mm. wide. Leaves 0.40–0.50 mm. long, unequal at base, cells at apex distinct, hexagonal or rounded, 0.003 × 0.013 mm. in diameter with thick brown walls, basal and central cells longer and narrower, 0.010 × 0.040 mm., the translucent marginal cells not papillose, dorsal cells with from 4–8 minute papillae. Fruit unknown.

Collected with *Lejeunea Sullivantii* by *W. S. Sullivant* near Augusta, Georgia, in 1845.

These specimens and a full series of notes were sent to Manchester, England, with Austin's hepatics and remained there a number of years in the herbarium of W. H. Pearson. They were subsequently returned and placed among the *Hepaticae* in the Columbia University Herbarium where they were found by Dr. M. A. Howe.

Erpodium Pringlei E. G. Britton, n. sp.

Plants in thin, appressed, glaucous-green mats: stems creeping and branching, branches short: leaves densely imbricate, squarrose with spreading points, ovate, 0.5 mm. long, apex acute or obtuse, papillose or hyaline, the cells hexagonal, papillose, large, 0.013 × 0.021 mm. in diameter, with brown walls thickened at angles, collenchymatic; margins entire or minutely papillose-crenulate, basal cells elongated and smooth; perichaetial leaves scarious, erect-clasping, apiculate, with clear apical cells; capsule half-immersed, 1 mm. long, lid apiculate, mouth bordered by red cells as well as the lid; peristome none: spores rough, 0.027–0.035 mm.

Type station: Mexico, near Guadalajara, *C. G. Pringle*, 1889, *no. 710*, on trees; Zapotlen, May 28, 1893, and Terzuela, July 2d, 1893, *no. 16a*.

This genus is not recorded for Mexico by Bescherelle in his *Prodromus Bryologiae Mexicanae*. Dr. Max Fleischer states that *E. diversifolium* C. Müll. appears to be only *E. domingense!*

NEW YORK BOTANICAL GARDEN.

INDEX TO AMERICAN BOTANICAL LITERATURE

(1905)

The aim of this Index is to include all current botanical literature written by Americans, published in America, or based upon American material; the word America being used in its broadest sense.

Reviews, and papers which relate exclusively to forestry, agriculture, horticulture, manufactured products of vegetable origin, or laboratory methods are not included, and no attempt is made to index the literature of bacteriology. An occasional exception is made in favor of some paper appearing in an American periodical which is devoted wholly to botany. Reprints are not mentioned unless they differ from the original in some important particular. If users of the Index will call the attention of the editor to errors or omission their kindness will be appreciated.

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Claassen, E. Key to the liverworts recognized in the sixth edition of Gray's Manual of botany. Ohio Nat. **5**: 312–315. 24 Ap 1905.
Key to the genera only.

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Special Publ. from "The Bahama Islands" (Geogr. Soc. Baltimore). In the list of plants collected, several are described as new.

Cotton, E. C. Key to Ohio ashes in the winter condition. Ohio Nat. **5**: 270. 24 Ja 1905.

Cushman, J. A. Notes on the zygospores of certain New England desmids, with descriptions of a few new forms. Bull. Torrey Club **32**: 223–229. *pl. 7, 8*. 6 My 1905.
With descriptions of 2 new species and several new varieties.

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Davis, B. M. Studies on the plant cell — V. Am. Nat. **39**: 217–268. *f. 16–18.* 26 Ap 1905.

Eastwood, A. New species of western plants. Bull. Torrey Club **32**: 193–218. 6 My 1905.
Descriptions of 38 new species in 26 genera.

Evans, A. W. New or noteworthy *Hepaticae* from Florida. Bull. Torrey Club **32**: 179–192. *pl. 5.* 6 My 1905.
Including new species in *Plagiochila*, *Cololejeunea*, and *Lejeunea*.

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Descriptions of 10 new species in *Cerasus.*

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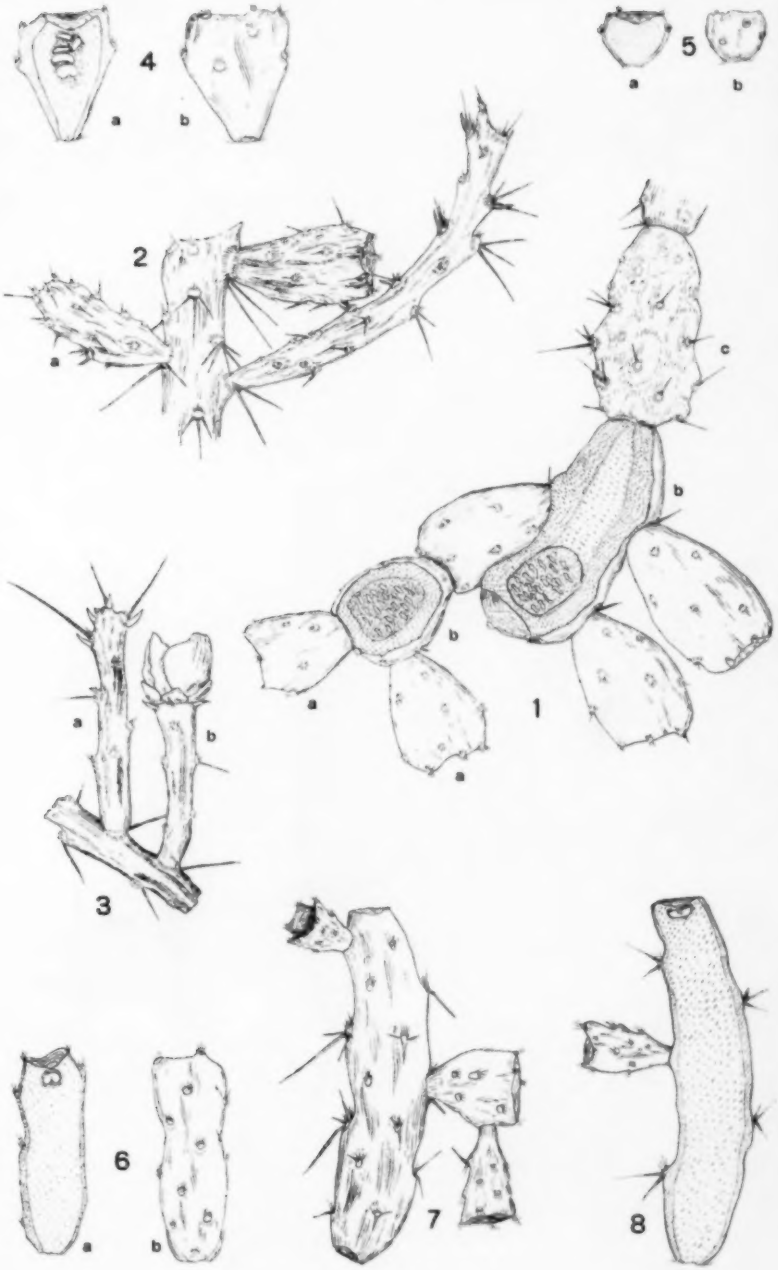

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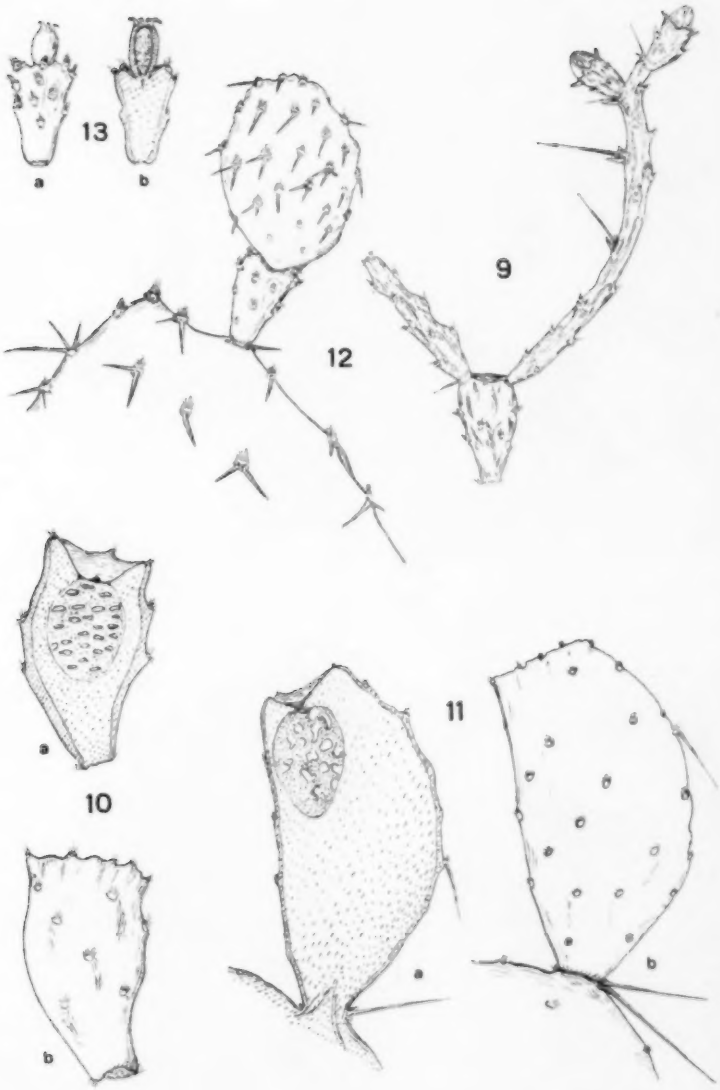

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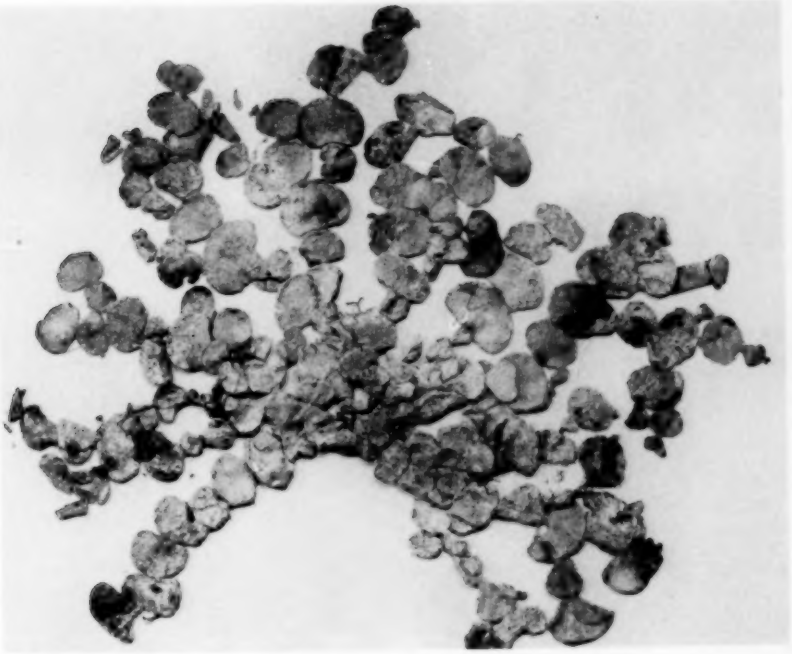

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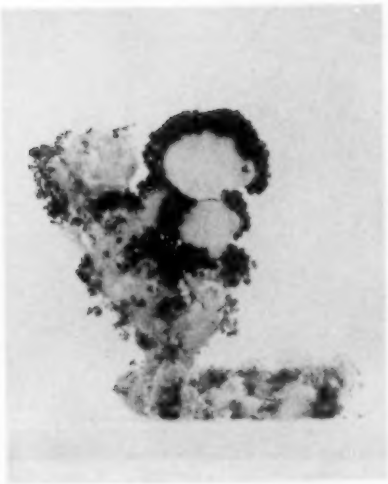

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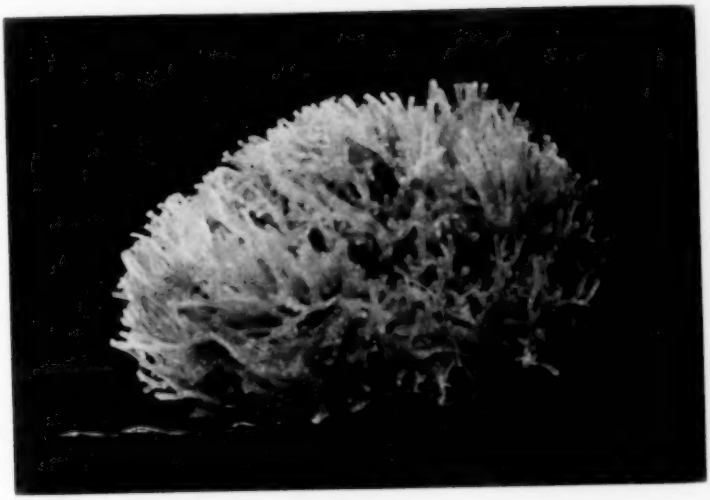

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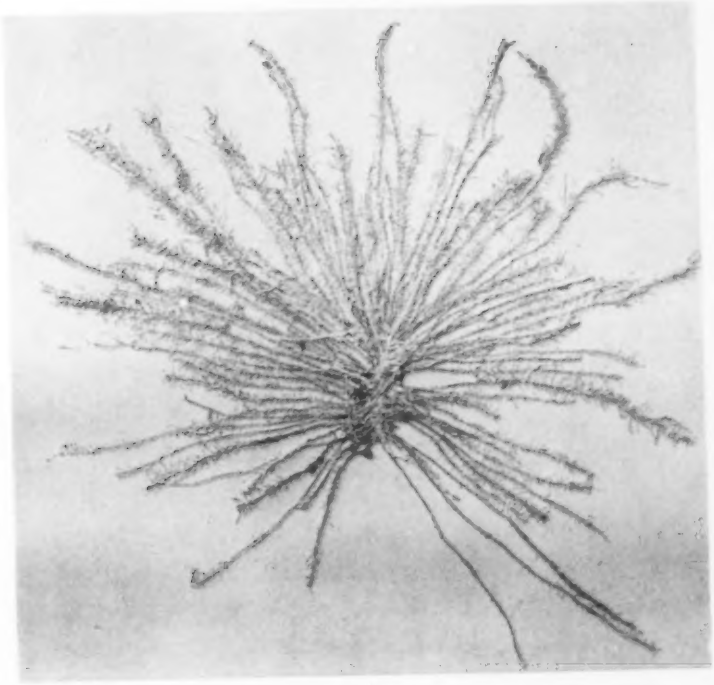

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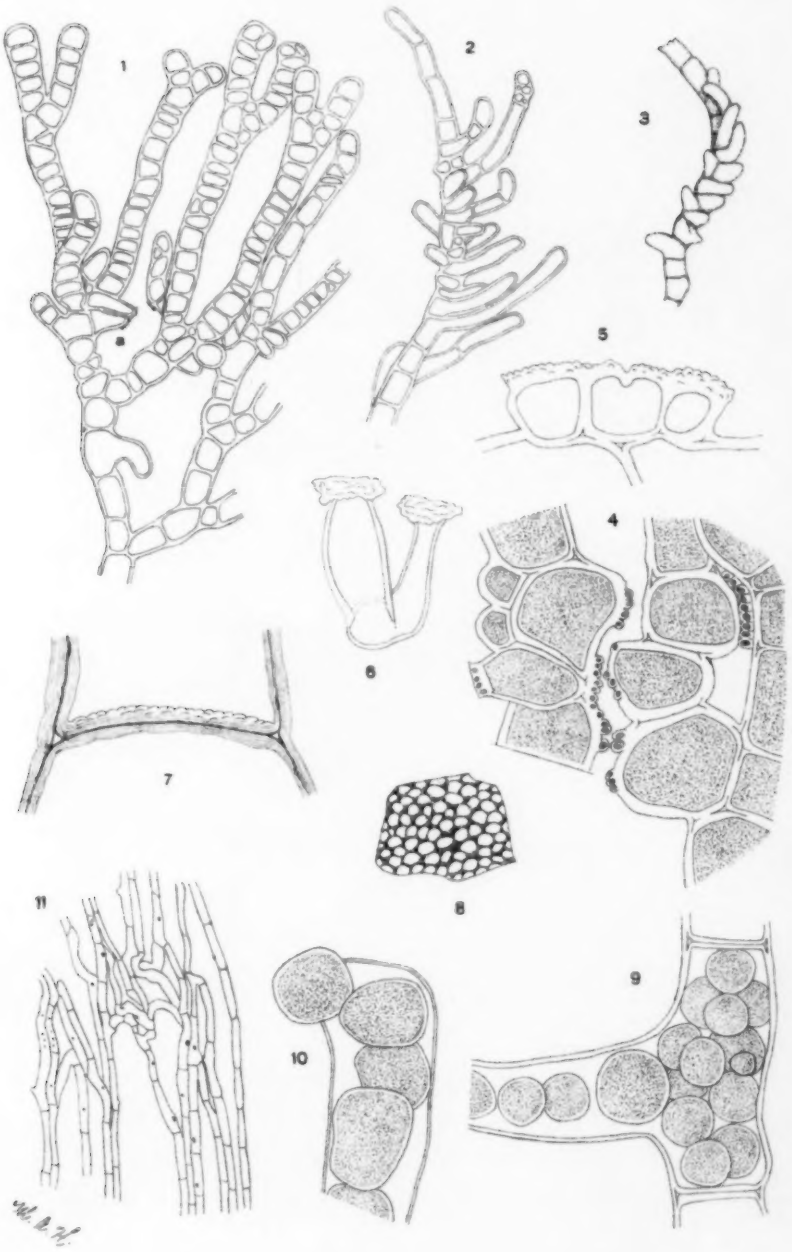

SIPHONOCLADUS RIGIDUS M. A. Howe.

PETROSIPHON ADHAERENS M. A. Howe

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VIOLA BRITTONIANA × CUCULLATA House

VIOLA PECTINATA Bicknell